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(54) LIQUID CRYSTAL PROJECTOR

SPECIFICATION

1. Title of the Invention:

LIQUID CRYSTAL PROJECTOR

2. Claim

A liquid crystal projector comprising a light source portion and a liquid crystal panel both of which are in a case, characterized in that a heat insulating wall having a light transmission window is provided between the light source portion and the liquid crystal panel.

3. Detailed Description of the Invention

[Technical Field of the Invention]

This invention relates to a liquid crystal projector.

[Description of the Related Arts]

In a liquid crystal projector, a transmission type liquid crystal display panel displays an image, and the image displayed on this liquid crystal display panel is projected and enlarged on a screen surface by a projection lens. This liquid crystal projector has the following arrangement.

That is, Fig. 4 shows a conventional liquid crystal projector, and reference numeral 1 in the drawing represents a case of the projector and a projection lens 2 in which a plurality of optical lenses are combined is provided in the front portion of the case 1. Furthermore, reference numeral 3 represents a transmission type dot-matrix liquid crystal display panel disposed in the front portion of the case 1 so as to face the projection lens 2, reference numeral 4 represents a light

source portion disposed behind the liquid crystal display panel 1 and provided in the rear portion of the case 1, the light source portion 4 comprises a light source lamp 5 and a reflector 6 for reflecting illumination light from the light source lamp 5 toward the rear side of the liquid crystal display panel 3, the illumination light from the light source portion 4 is incident on the liquid crystal display panel 3 after the infrared component is eliminated by an infrared elimination filter (infrared reflection filter or infrared absorption filter) 8. Moreover, in Fig. 4, although a liquid crystal projector using a parabolic reflector having a parabolic reflecting surface which reflects the light from the light source lamp 5 as collimated light toward the side of the liquid crystal display panel 3 was shown, in a liquid crystal projector using a conventional elliptical reflector as the reflector, a relay lens is arranged between the light source portion and the liquid crystal display panel and the reflected light from the reflector is corrected by the relay lens to obtain collimated light and the collimated light is led to the liquid crystal display panel. Furthermore, in Fig. 4, reference numeral 7 represents an eccentric Fresnel lens arranged in the front side of the liquid crystal display panel 1, the light passing through the liquid crystal display panel 3, that is, an image on the liquid crystal display panel 3 is directed in a fixed direction to the projection lens 2 by the eccentric Fresnel lens 7, and its image is enlarged and projected onto a screen surface S by the projection lens 2. Moreover, the liquid crystal display panel 3 is of a TN (Twisted Nematic) type and the liquid crystal display panel 3 is

inclined at a fixed angle with respect to the optical axis of the light source side such that the illumination light from the rear side of the panel has the highest efficiency. Furthermore, reference numeral 9a represents an intake provided in a part of the case 1, reference numeral 9b represents an outlet having a ventilating fan 10, and the inside of the case 1 is air cooled by outside air drawn from the intake 9a and exhausted from the outlet 9b.

That is, this conventional liquid crystal projector enlarges and projects the image displayed on a liquid crystal display panel onto a screen surface, and, according to the liquid crystal projector, slide films need not to be inserted or extracted, unlike in the conventional liquid crystal projector using slide films, and can project an animation such as a television image on the screen surface.

[Problems to be Solved by the Invention]

However, in the conventional liquid crystal projector, although the heat of the illumination light from the light source portion by which the liquid crystal display panel 3 is illuminated is shut off to some extent by an infrared elimination filter 8, because the heat radiated around the light source portion 4 by the light source portion 4 also reaches the front side of the case directly or after reflected by the inside surface of the case 1 and makes the temperature inside the case 1 rise, the temperature of the surface of the liquid crystal display panel 3 which is disposed in the front side of the case goes up, and, accordingly, there was a problem that the degradation of the display contrast, the breakdown of the inside liquid crystal, etc are caused.

Moreover, although the temperature rise inside the case 1 can be suppressed to some extent by air cooling the inside of the case 1 through ventilation inside the case 1, because high-intensity xenon lamps, etc., which are generally used for the light source lamp 4a are accompanied by considerable heat generation, since it is difficult to suppress the temperature rise inside the case 1 to a certain degree where the heat does not adversely affect the liquid crystal display panel 3, the degradation of the display contrast of the liquid crystal display panel 3, the thermal breakdown of the liquid crystal, etc., by the heat could not be completely prevented.

The present invention was made in consideration of the above-described actual circumstances, and its object is to provide a liquid crystal projector in which the liquid crystal display panel can be prevented from being exposed to the heat radiated from the light source portion and the degradation of the display contrast, the thermal breakdown of the liquid crystal, etc., can be prevented by suppressing the temperature rise of the liquid crystal display panel so as to be low.

[Means for Solving the Problems and Operation]

That is, in the present invention, a liquid crystal projector comprises a light source portion and a liquid crystal panel both of which are in a case and is characterized in that a heat insulating wall having a light transmission window is provided between the light source portion and the liquid crystal panel, and, according to the present invention, because the heat radiated from the light source portion is shut off by the above-mentioned heat insulating wall, since the liquid

crystal panel is prevented from being exposed to the radiated heat from the light source portion, the degradation of the display contrast, the thermal breakdown of the liquid crystal, etc., can be prevented by suppressing the temperature rise of the liquid crystal display panel so as to be low.

[Embodiment]

Hereinafter, one embodiment according to the present invention is described with reference to the drawings.

In Fig. 1, reference numeral 11 represents a case of a liquid crystal projector, and a projection lens 12, in which a plurality of optical lenses are provided in proximity in a row arrangement, is provided in the front portion of the case 11. Reference numeral 13 represents a transmission type dot matrix liquid crystal display panel which is disposed in the front portion of the case 10 so as to face the projection lens 12, and an eccentric Fresnel lens 17 for condensing the light passing through the liquid crystal display panel 13 in a fixed direction to the projection lens 12 is provided on the front side of the liquid crystal display panel 13. Furthermore, in the rear portion of the case 11, a light source portion 14, which is disposed in the rear of the liquid crystal panel 13 and illuminates the liquid crystal panel 13 from the back side, is provided. This light source portion 14 is composed of a light source lamp 15 such as a xenon lamp, etc., and a reflector 16 for reflecting the illuminating light from the light source lamp 15 toward the rear surface of the liquid crystal display panel 13, and the reflector 16 is made a parabolic reflector for reflecting the

light from the light source 15 as a collimated light beam.

Reference numeral 19 represents a heat insulating wall which is provided in the case 1 and divides the inside of the case 1 into the side of the light source portion 14 and the side where the liquid crystal display panel 13 is disposed, and a light transmission window 19a transmitting only the illuminating light from the light source portion 14 toward the liquid crystal display panel 13 is provided in the heat insulating wall 9. An infrared beam elimination filter (infrared reflection filter or infrared absorption filter) 18 is provided in this light transmission window 19a, and the illuminating light from the light source portion 14 is made incident on the liquid crystal display panel 13 after the infrared component of the illuminating light is eliminated by the infrared beam elimination filter 18. Moreover, the heat insulating wall 19 is made of a heat insulating material such as wood, urethane, rock wool, calcium silicate, etc.

Furthermore, in Fig. 1, reference numeral 20 represents a light source portion cooling air blower which air-cools the light source lamp 15 and the reflector 16 in the light source portion 14, and the air blower 20 is provided such that a cooling air (air inside the case 11) is blown in an oblique direction toward the light source portion 14.

Furthermore, reference numeral 21 represents a display panel cooling device provided on the rear side of the liquid crystal display panel 13. This display panel cooling device 21 is constructed such that a cooling liquid such as an ethylene glycol water solution, etc., is filled in the tightly closed main body 21a of the cooling device which

is formed by setting a frame body 22 sufficiently larger than a display screen 13a of the liquid crystal display panel 13 on the rear surface of the liquid crystal display panel 13 and by setting a transparent plate 23 on the side of the light source, as shown in Figs. 2 and 3, and that heat pipes 24 and 24 are inserted in both sides of the main body 22 of the cooling device so as to keep out of the display screen 13a of the liquid crystal display panel 13. The above heat pipes 24 and 24 constructed such that a volatile coolant is filled in the pipe both ends of which are closed, and air cooling fins 25 and 25 are set in the protruded portion of the heat pipes 24 and 24 above the main body 21a of the cooling device. The coolant in the heat pipes 24 and 24 goes up when heated by the heat in the main body 21a of the cooling device, and the coolant goes down to the side of the cooling device 21a when cooled at the air cooling fins by the air inside the case 1, and the cooling liquid a in the main body 21a of the cooling device is always cooled because the coolant in the heat pipes 24 and 24 is circulated by convection. That is, this display panel cooling device 21 cools the liquid crystal display panel 13 at its rear side, and when the illuminating light from the light source portion 14 is made to be incident on the liquid crystal display panel 13 through the display panel cooling device 21, it is able to prevent the heat of the illuminating light (infrared component which is not eliminated by the infrared elimination filter 18) from heating the liquid crystal display panel 13 and to completely prevent its thermal breakdown. Moreover, a general transparent plate such as a glass plate, etc., may be used for

(as) the transparent plate 23 on the light source side of the main body 21a of the cooling device, but when an infrared absorption filter or an infrared reflecting filter is used for the transparent plate 23, the infrared component in the illuminating light can be shut out double together with the above described infrared elimination filter 18, and accordingly it is able to more effectively prevent the liquid crystal display panel 13 from being heated.

Furthermore, in Fig. 1, reference numerals 26a and 26b represent intake vents provided in the front and rear portions of the case 1, and reference numeral 27 represents an outlet provided in the upper surface of the case 11, and this outlet 27 is provided so as to extend over the side of the light source portion and the display panel disposed side in the case 11 which is divided by the above heat insulating wall. A ventilating fan 28 for drawing outside air from the intakes 26a and 26b and exhausting the air from the outlet 27 is provided in the outlet 27, the display panel disposed side in the case 11 divided by the heat insulating wall 19 is air cooled by outside air drawn from the intake 26a in the front portion of the case and exhausted from the outlet 27, and the side of the light source portion is air cooled by outside air drawn from the intake 26b in the rear portion of the case and exhausted from the outlet 27.

In this way, in this liquid crystal projector, since the inside of the case 11 of the projector is divided into the side of the light source portion and the display panel disposed side by the heat insulating wall having the transparent window 19a for the illuminating

light traveling from the light source portion 14 toward the liquid crystal display panel 13, as described above, the heat radiated by the light source portion 14 is shut out by the above heat insulating wall 19. Therefore, according to this liquid crystal projector, since the liquid crystal panel 13 is prevented from being exposed to the radiation heat from the light source portion 14 and the heating up of the display panel disposed side of the case 11 can be also suppressed so as to be low, it is able to suppress the temperature rise of the liquid crystal panel 13 to be low and to prevent the degradation of the display contrast, the thermal breakdown of the liquid crystal, etc. Furthermore, when the display panel cooling device 24 is provided on the rear side of the liquid crystal panel 13 (incident side of the illumination light), the adverse effect of the heat on the liquid crystal panel 13 can be further surely prevented.

Moreover, in the above embodiment, although the infrared elimination filter 18 for eliminating the infrared component in the illuminating light from the light source portion 14 is provided in the light transmission window 19a of the heat insulating wall 19, this infrared elimination filter 18 may be provided separately from the heat insulating window 19. Furthermore, in the above embodiment, although the reflector 16 of the light source portion 14 is a parabolic reflector for reflecting the light from the light source lamp 15 as parallel rays toward the side of the liquid crystal panel 13, this reflector 16 may be made a general elliptical mirror finish reflector, and then a relay lens may be provided to correct the illumination light from the light source

portion 14 so as to be parallel rays.

[Advantages]

In a liquid crystal projector having a light source portion and a liquid crystal display panel according to the present invention, since a heat insulating wall having a light transmission window is provided, the liquid crystal display panel is not exposed to the radiation heat from the light source portion, and accordingly it is able to suppress the temperature rise of the liquid crystal display panel so as to be low and to prevent the degradation of the display contrast, the thermal breakdown of the liquid crystal, etc.

4. Brief Description of the Drawings

Figs. 1 to 3 show one embodiment according to the present invention, Fig. 1 is a longitudinal side view of a liquid crystal projector, Figs. 2 and 3 are a front view, partly cut away, and a longitudinal side view of a display panel cooling device provided on the rear side of a liquid crystal display panel. Fig. 4 is a longitudinal side view of a conventional liquid crystal projector.

11 ··· case, 12 ··· projection lens, 13 ··· liquid crystal display panel, 14 ··· light source portion, 15 ··· light source lamp, 16 ··· parabolic reflector, 18 ··· light source portion elimination filter, 19 ··· heat insulating wall, 19a ··· light transmission window, 21 ··· display panel cooling device, S ··· screen

FIG. 1

11 CASE

12 PROJECTION LENS

13 LIQUID CRYSTAL DISPLAY PANEL

14 LIGHT SOURCE PORTION

18 LIGHT SOURCE PORTION ELIMINATION FILTER

19 HEAT INSULATING WALL

S SCREEN

FIG. 2

FIG. 3

FIG. 4